

the educational and cognitive capabilities of the intended operator;

(6) Use complete words where possible; where abbreviations are necessary, choose a commonly accepted abbreviation or consistent method and select commonly used terms and words that the operator will understand;

(7) Adopt a consistent format for all display screens by placing each design element in a consistent and specified location;

(8) Display critical information in the center of the operator's field of view by placing items that need to be found quickly in the upper left hand corner and items which are not time-critical in the lower right hand corner of the field of view;

(9) Group items that belong together;

(10) Design all visual displays to meet human performance criteria under monochrome conditions and add color only if it will help the user in performing a task, and use color coding as a redundant coding technique;

(11) Limit the number of colors over a group of displays to no more than seven;

(12) Design warnings to match the level of risk or danger with the alerting nature of the signal; and

(13) With respect to information entry, avoid full QWERTY keyboards for data entry.

(g) With respect to problem management, the HMI designer shall ensure that the:

(1) HMI design must enhance an operator's situation awareness;

(2) HMI design must support response selection and scheduling; and

(3) HMI design must support contingency planning.

(h) Ensure that electronics equipment radio frequency emissions are compliant with appropriate Federal Communications Commission regulations. The FCC rules and regulations are codified in Title 47 of the Code of Federal Regulations (CFR).

(1) Electronics equipment must have appropriate FCC Equipment Authorizations. The following documentation is applicable to obtaining FCC Equipment Authorization:

(i) OET Bulletin Number 61 (October, 1992 Supersedes May, 1987 issue) FCC Equipment Authorization Program for Radio Frequency Devices. This document provides an overview of the equipment authorization program to control radio interference from radio transmitters and certain other electronic products and an overview of how to obtain an equipment authorization.

(ii) OET Bulletin 63: (October 1993) Understanding The FCC Part 15 Regulations for Low Power, Non-Licensed Transmitters. This document provides a basic understanding of the FCC regulations for low power, unlicensed transmitters, and includes answers to some commonly-asked questions. This edition of the bulletin does not contain

information concerning personal communication services (PCS) transmitters operating under Part 15, Subpart D of the rules.

(iii) 47 Code of Federal Regulations Parts 0 to 19. The FCC rules and regulations governing PCS transmitters may be found in 47 CFR, Parts 0 to 19.

(iv) OET Bulletin 62 (December 1993) Understanding The FCC Regulations for Computers and other Digital Devices. This document has been prepared to provide a basic understanding of the FCC regulations for digital (computing) devices, and includes answers to some commonly-asked questions.

(2) Designers must comply with FCC requirements for Maximum Permissible Exposure limits for field strength and power density for the transmitters operating at frequencies of 300 kHz to 100 GHz and specific absorption rate (SAR) limits for devices operating within close proximity to the body. The Commission's requirements are detailed in parts 1 and 2 of the FCC's Rules and Regulations (47 CFR 1.1307(b), 1.1310, 2.1091, 2.1093). The following documentation is applicable to demonstrating whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to radiofrequency RF fields adopted by the FCC:

(i) OET Bulletin No. 65 (Edition 97–01, August 1997), "Evaluating Compliance With FCC Guidelines For Human Exposure To Radiofrequency Electromagnetic Fields";

(ii) OET Bulletin No 65 Supplement A, (Edition 97–01, August 1997), OET Bulletin No 65 Supplement B (Edition 97–01, August 1997) and

(iii) OET Bulletin No 65 Supplement C (Edition 01–01, June 2001).

(3) The bulletin and supplements offer guidelines and suggestions for evaluating compliance. However, they are not intended to establish mandatory procedures. Other methods and procedures may be acceptable if based on sound engineering practice.

[75 FR 2720, Feb. 15, 2010]

APPENDIX F TO PART 236—MINIMUM REQUIREMENTS OF FRA DIRECTED INDEPENDENT THIRD-PARTY ASSESSMENT OF PTC SYSTEM SAFETY VERIFICATION AND VALIDATION

(a) This appendix provides minimum requirements for mandatory independent third-party assessment of PTC system safety verification and validation pursuant to subpart H or I of this part. The goal of this assessment is to provide an independent evaluation of the PTC system manufacturer's utilization of safety design practices during the PTC system's development and testing phases, as required by the applicable PSP, PTCDP, and PTCSP, the applicable requirements of subpart H or I of this part, and any

other previously agreed-upon controlling documents or standards.

(b) The supplier may request advice and assistance of the independent third-party reviewer concerning the actions identified in paragraphs (c) through (g) of this appendix. However, the reviewer should not engage in design efforts in order to preserve the reviewer's independence and maintain the supplier's proprietary right to the PTC system.

(c) The supplier shall provide the reviewer access to any and all documentation that the reviewer requests and attendance at any design review or walkthrough that the reviewer determines as necessary to complete and accomplish the third party assessment. The reviewer may be accompanied by representatives of FRA as necessary, in FRA's judgment, for FRA to monitor the assessment.

(d) The reviewer shall evaluate with respect to safety and comment on the adequacy of the processes which the supplier applies to the design and development of the PTC system. At a minimum, the reviewer shall evaluate the supplier design and development process regarding the use of an appropriate design methodology. The reviewer may use the comparison processes and test procedures that have been previously agreed to with FRA. Based on these analyses, the reviewer shall identify and document any significant safety vulnerabilities which are not adequately mitigated by the supplier's (or user's) processes. Finally, the reviewer shall evaluate the adequacy of the railroad's applicable PSP or PTCSP, and any other documents pertinent to the PTC system being assessed.

(e) The reviewer shall analyze the Hazard Log and/or any other hazard analysis documents for comprehensiveness and compliance with railroad, vendor, supplier, industry, national, or international standards.

(f) The reviewer shall analyze all Fault Tree Analyses (FTA), Failure Mode and Effects Criticality Analysis (FMECA), and other hazard analyses for completeness, correctness, and compliance with railroad, vendor, supplier, industry, national, or international standards.

(g) The reviewer shall randomly select various safety-critical software modules, as well as safety-critical hardware components if required by FRA for audit to verify whether the railroad, vendor, supplier, industry, national, or international standards were followed. The number of modules audited must be determined as a representative number sufficient to provide confidence that all unaudited modules were developed in compliance with railroad, vendor, supplier, industry, national, or international standards.

(h) The reviewer shall evaluate and comment on the plan for installation and test procedures of the PTC system for revenue service.

(i) The reviewer shall prepare a final report of the assessment. The report shall be submitted to the railroad prior to the commencement of installation testing and contain at least the following information:

(1) Reviewer's evaluation of the adequacy of the PSP or PTCSP including the supplier's MTTHE and risk estimates for the PTC system, and the supplier's confidence interval in these estimates;

(2) PTC system vulnerabilities, potentially hazardous failure modes, or potentially hazardous operating circumstances which the reviewer felt were not adequately identified, tracked or mitigated;

(3) A clear statement of position for all parties involved for each PTC system vulnerability cited by the reviewer;

(4) Identification of any documentation or information sought by the reviewer that was denied, incomplete, or inadequate;

(5) A listing of each applicable vendor, supplier, industry, national or international standard, process, or procedure which was not properly followed;

(6) Identification of the hardware and software verification and validation procedures for the PTC system's safety-critical applications, and the reviewer's evaluation of the adequacy of these procedures;

(7) Methods employed by PTC system manufacturer to develop safety-critical software; and

(8) If directed by FRA, methods employed by PTC system manufacturer to develop safety-critical hardware.

[75 FR 2721, Jan. 15, 2010]

PART 237—BRIDGE SAFETY STANDARDS

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